

Claims

- 1 1. A device for attaching to a living subject, comprising a first sensor, a second sensor, a
2 processor, and a storage device, said a first sensor for attaching to a first body
3 segment above a hip joint, said second sensor for attaching to a second body segment
4 below the hip joint, wherein said first sensor and said second sensor each comprise an
5 inclination measuring device, wherein data from said first sensor and from said
6 second sensor is processed in said processor and stored in said storage device for
7 distinguishing lying, sitting, and standing positions.
- 1 2. A device as recited in claim 1, wherein said inclination measuring device comprises a
2 solid state device.
- 1 3. A device as recited in claim 2, wherein said inclination measuring device comprises a
2 dc accelerometer.
- 1 4. A device as recited in claim 1, wherein said inclination measuring device comprises
2 three accelerometers orthogonally mounted.
- 1 5. A device as recited in claim 1, wherein said inclination measuring device further
2 comprises a magnetometer.
- 1 6. A device as recited in claim 5, wherein said inclination measuring device comprises a
2 plurality of magnetometers.
- 1 7. A device as recited in claim 1, wherein said magnetometer data is for providing
2 direction with respect to the earth's magnetic field.

- 1 8. A device as recited in claim 1, wherein data from said first sensor is subtracted from
2 data from said second sensor.
- 1 9. A device as recited in claim 8, wherein said subtraction is to determine a difference in
2 orientation.
- 1 10. A device as recited in claim 8, wherein said first sensor and said second sensor are for
2 measuring range of motion of said second body segment with respect to said first
3 body segment.
- 1 11. A device as recited in claim 10, wherein said range of motion measurement data is
2 analyzed for change of range of motion over time.
- 1 12. A device as recited in claim 11, wherein initial values of said time dependent data are
2 tared out to provide change from said initial values.
- 1 13. A device as recited in claim 1, wherein said storage device comprises a solid state
2 device.
- 1 14. A device as recited in claim 13, wherein said storage device comprises a non-volatile
2 memory device.
- 1 15. A device as recited in claim 1, further comprising a feedback mechanism
- 1 16. A device as recited in claim 16, further comprising a housing, wherein said first
2 sensor, said storage device, said processor, and said feedback mechanism are all
3 within said housing.

- 1 17. A device as recited in claim 15, further comprising a housing separate from said first
2 sensor and said second sensor, wherein said feedback mechanism is within said
3 housing.
- 1 18. A device as recited in claim 17, wherein said first sensor and said second sensor are
2 wirelessly connected to said housing containing said feedback mechanism.
- 1 19. A device as recited in claim 18, wherein said wireless connection is an RF
2 connection.
- 1 20. A device as recited in claim 15, wherein said feedback mechanism is activated if a
2 preset range of motion threshold has been exceeded too many times.
- 1 21. A device as recited in claim 15, wherein said feedback mechanism provides vibratory
2 or auditory feedback.
- 1 22. A device as recited in claim 15, wherein said feedback mechanism comprises a piezo-
2 electric buzzer or an electromagnetic shaker.
- 1 23. A device as recited in claim 15, wherein said feedback mechanism provides feedback
2 to warn of a problem, discourage a movement, support a desired result, or encourage a
3 movement.
- 1 24. A device as recited in claim 23, wherein said problem comprises repeatedly exceeding
2 a pre-programmed inclination angle.
- 1 25. A device as recited in claim 1, wherein said processor comprises a microprocessor, a

2 signal processor, or a personal computer.

1 26. A device as recited in claim 1, wherein said data comprises body segment orientation
2 data as a function of time.

1 27. A device as recited in claim 1, wherein said data comprises posture data as a function
2 of time.

1 28. A device as recited in claim 1, wherein said data is used to adjust physical therapy.

1 29. A device as recited in claim 1, wherein said device further comprises a data entry
2 system.

1 30. A device as recited in claim 29, wherein said data entry system comprises a button.

1 31. A device as recited in claim 29, wherein said data entry system is for recording the
2 presence of pain.

1 32. A device as recited in claim 29, wherein time, date or other data are recorded when
2 said data entry system is used.

1 33. A device as recited in claim 1, wherein said data is displayed as a histogram showing
2 number of inclinations at each angle range during a time period.

1 34. A device as recited in claim 1, wherein said data is displayed as inclination v. time.

1 35. A device as recited in claim 1, further comprising a digital filter.

- 1 36. A device as recited in claim 35, wherein said digital filter is for reducing effect of
2 linear accelerations on the data.
- 1 37. A device as recited in claim 35, wherein said digital filter comprises a low pass filter
2 or a high pass filter.
- 1 38. A device as recited in claim 1, further comprising a high pass filter, wherein output of
2 said accelerometers that passes through said high pass filter is subsequently integrated
3 and used to compute a resultant velocity which is used to calculate energy used.
- 1 39. A device as recited in claim 1, wherein said device is further for determining body
2 posture in said sitting position.

1 40. A device comprising a sensor, a processor, a storage device, and a feedback
2 mechanism wherein data from said sensor is processed in said processor to provide an
3 output, wherein said output is stored in said storage device as a function of time, and
4 wherein multiple points of said time dependent output stored in said storage device
5 are processed in said processor, wherein said processor directs said feedback
6 mechanism to provide information or instruction in response to said multiple points of
7 time dependent output indicating too little activity or too small a range of motion of a
8 joint during an interval of time, or repetitive activity that can cause repetitive stress
9 injury or too many motions beyond a specified range of motion during an interval of
10 time or too much vibration for too long a time.

1 41. A device as recited in claim 1, wherein said sensor comprises an inclination
2 measuring device

1 42. A device as recited in claim 41, wherein said inclination measuring device comprises
2 a solid state device.

1 43. A device as recited in claim 42, wherein said inclination measuring device comprises
2 a dc accelerometer.

1 44. A device as recited in claim 43, wherein said inclination measuring device comprises
2 three accelerometers orthogonally mounted.

1 45. A device as recited in claim 43, wherein said inclination measuring device further
2 comprises a magnetometer.

1 46. A device as recited in claim 45, wherein said inclination measuring device comprises

2 a plurality of magnetometers.

1 47. A device as recited in claim 45, wherein said magnetometer is for providing direction
2 with respect to the earth's magnetic field.

1 48. A device as recited in claim 40, further comprising a network of said sensors.

1 49. A device as recited in claim 48, wherein a first sensor of said network of sensors is for
2 placing on a first body segment and a second sensor of said network of sensors is for
3 placing on a second body segment connected to said first body segment.

1 50. A device as recited in claim 49, wherein output from said sensor is subtracted from
2 data from said second sensor to provide angle of a joint there between.

1 51. A device as recited in claim 49, wherein said first sensor and said second sensor are
2 for measuring range of motion of said second body segment with respect to said first
3 body segment.

1 52. A device as recited in claim 51, wherein said range of motion measurement data is
2 analyzed for change of range of motion over time.

1 53. A device as recited in claim 51, wherein an initial values of said time dependent data
2 is tared out for said first sensor and said second sensor to provide change from said
3 initial value.

1 54. A device as recited in claim 40, wherein said storage device comprises a solid state
2 device.

1 55. A device as recited in claim 54, wherein said storage device comprises a non-volatile
2 memory device.

1 56. A device as recited in claim 1, wherein said storage device and said processor are
2 within the same housing.

1 57. A device as recited in claim 40, further comprising a housing, wherein said sensor,
2 said storage device, said processor, and said feedback mechanism are all within said
3 housing.

1 58. A device as recited in claim 40, further comprising a housing separate from said
2 sensor, wherein said feedback mechanism is within said separate housing.

1 59. A device as recited in claim 58, wherein said sensor is wirelessly connected to said
2 housing containing said feedback mechanism.

1 60. A device as recited in claim 59, wherein said wireless connection is an RF
2 connection.

1 61. A device as recited in claim 40, wherein said feedback mechanism is activated if a
2 preset range of motion threshold has been exceeded more than a specified number of
3 times.

1 62. A device as recited in claim 40, wherein said feedback mechanism provides vibratory
2 or auditory feedback.

1 63. A device as recited in claim 40, wherein said feedback mechanism comprises a piezo-
2 electric buzzer or an electromagnetic shaker.

1 64. A device as recited in claim 40, wherein said feedback mechanism provides feedback
2 to warn of a problem, discourage a movement, support a desired result, or encourage a
3 movement.

1 65. A device as recited in claim 64, wherein said problem comprises repeatedly exceeding
2 a pre-programmed inclination angle.

1 66. A device as recited in claim 40, wherein said processor comprises a microprocessor, a
2 signal processor, or a personal computer.

1 67. A device as recited in claim 40, wherein said output comprises body segment
2 orientation data as a function of time.

1 68. A device as recited in claim 40, wherein said output comprises posture data as a
2 function of time.

1 69. A device as recited in claim 40, wherein said output is used to adjust physical therapy.

1 70. A device as recited in claim 40, wherein said device further comprises a data entry
2 system.

1 71. A device as recited in claim 70, wherein said data entry system comprises a button.

1 72. A device as recited in claim 70, wherein said data entry system is for recording the
2 presence of pain.

1 73. A device as recited in claim 70, wherein time, date or other data are recorded when

2 said data entry system is used.

1 74. A device as recited in claim 40, wherein said output is displayed as a histogram
2 showing number of inclinations at each angle range during a time period.

1 75. A device as recited in claim 40, wherein said output is displayed as inclination v.
2 time.

1 76. A device as recited in claim 40, further comprising a digital filter.

1 77. A device as recited in claim 76, wherein said digital filter is for reducing effect of
2 linear accelerations on the data.

1 78. A device as recited in claim 76, wherein said digital filter comprises a low pass filter.

1 79. A device as recited in claim 40, further comprising a high pass filter, wherein output
2 of said accelerometers that passes through said high pass filter is subsequently
3 integrated and used to compute a resultant velocity which is used to calculate energy
4 used.

1 80. A device as recited in claim 40, wherein said device is further for determining body
2 posture in said sitting position.

1 81. A device as recited in claim 40, wherein said device is wearable.

1 82. A device as recited in claim 40, wherein said device records output over a series of
2 intervals of time.
3